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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BOARD OF PATENT APPEALS AND INTERFERENCES

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In re Application of:		:
		: Confirmation No.: 8160
	Eckart HETTLAGE	:
		: Examiner: D. Le
For:	ROTARY ACTUATOR AND ROTARY SWITCH	:
		:
		: Art Unit: 2834
		:
Filed:	December 23, 2001	:
		:
Serial No.:	09/890,831	:
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APPEAL BRIEF PURSUANT TO 37 C.F.R. § 1.192(a)

SIR:

On February 23, 2004, Appellant filed a Notice of Appeal from the final rejection of claims 13, 14, and 16-25 contained in the Final Office Action issued by the U.S. Patent and Trademark Office on September 23, 2003, in the above-identified patent application.

In accordance with 37 C.F.R. § 1.192(a), this brief is submitted in triplicate in support of the appeal of the final rejection of claims 13, 14, and 16-25. For the reasons set forth below, the final rejection of claims 13, 14, and 16-25 should be reversed.

1. REAL PARTY IN INTEREST

The real party in interest in the present appeal is Robert Bosch GmbH, Stuttgart, Federal Republic of Germany. Robert Bosch GmbH is the assignee of the entire

right, title, and interest in the above-identified application.

2. RELATED APPEALS AND INTERFERENCES

There are no interferences or other appeals related to the above-identified application.

3. STATUS OF CLAIMS

Claims 13, 14, 16-23, and 25 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over United States Patent No. 4,983,867 to Sakamoto ("Sakamoto") in view of United States Patent No. 4,755,732 to Ando ("Ando").

Claim 24 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over Sakamoto in view of Ando and further in view of United States Patent No. 4,803,389 to Ogawa et al. ("Ogawa").

4. STATUS OF AMENDMENTS

No amendment has been filed subsequent to the Final Office Action mailed on December 18, 2003.

5. SUMMARY OF THE INVENTION

The present invention relates to a rotary actuator that includes elements for exerting a corrective torque on a rotor and for placing the rotor in a target position from a second plurality of positions, a target position being assigned to each position of a first plurality. The corrective torque is smaller than the torque to be exerted by the stator windings and the range of the corrective smaller is significantly smaller. The elements for exerting the corrective torque are significantly smaller and more compact. (Specification, page 2, lines 17-29)

Furthermore, the elements may be permanent magnets and therefore do not need to be wired. Additionally, the stator windings may be arranged about the rotor in an unpaired fashion, which cuts in half the number of contacts that are needed for the power supply of the stator windings, and that must be soldered or connected in some other manner. (Specification, page 2, line 31 to page 3, line 4)

According to an exemplary embodiment of the present invention, a rotary

actuator includes three stator windings 1, 2, 3 arranged in a rim-like fashion, symmetrically about an axis 6. The stator windings 1, 2, 3, may be selectively connected to a power supply, the polarity of power supply terminals 8 of the stator windings being selected so that windings 1 and 3 generate a magnetic field that is equally oriented with respect to an imaginary circumferential line 9, and stator winding 2 generates a magnetic field having the opposite orientation. As a result of a current being sent through stator windings 1, 2, 3, magnetic fields B_1, B_2, B_3, having the orientations depicted in Figure 1b, are obtained, which are offset by 60° with respect to each other. A rotor 7, e.g., as a bar magnet, may rotate freely about axis 6 under the influence of the magnetic fields generated by stator windings 1, 2, 3. The rotor 7 may adopt other positions corresponding to the orientation of magnetic fields B_2, B_3, if one of windings 2, 3 is supplied with current. (Specification, page 4, lines 6-20)

Also, four auxiliary magnets 11, 12, 13, 14 are mounted so as to be radially oriented at different locations outside the area covered by rotor 7 in its rotary motion. A first auxiliary magnet 11 is mounted in a position which shifts the orientation of magnetic field B_1 by 7.5° in the clockwise direction. Auxiliary magnet 11 has a polarity such that it exerts an attractive force on rotor 7 in the position depicted in Figure 1a adopted under the influence of magnetic field B_1. If the power supply to winding 1 is terminated, rotor 7 under the influence of auxiliary magnet 11 rotates to a target position Z_1, in which it is directly facing auxiliary magnet 11. A further auxiliary magnet 14 is arranged so as to be offset with respect to auxiliary magnet 11 by 45° in the clockwise direction and to have a polarity that is opposite to the latter's. Under the influence of a magnetic field generated by winding 3, rotor 7 adopts a position corresponding to vector B_3, if this magnetic field is switched off, rotor 7 under the influence of auxiliary magnet 14 rotates 7.5° to a target position, which corresponds to vector Z_4. Vectors Z_1, Z_4 constitute an angle of 135°. Two further auxiliary magnets 12, 13 are arranged to maintain rotor 7 in target positions Z_2, Z_3. Four target positions Z_1, Z_2, Z_3, Z_4 are offset by 45° with respect to each other. (Specification, page 4, line 25 to page 5, line 10)

The auxiliary magnets 11, 12, 13, 14 are dimensioned and have the capacity to pull the rotor to themselves from an angular distance of up to roughly +/-20°. Auxiliary magnets 11, 13, on the one hand, and 12, 14, on the other hand, have different polarities with respect to the radial direction and cooperate with different poles of rotor 7. The influence of each of them may be supported by a second auxiliary magnet situated diametrically opposite.

If the rotary actuator has four target positions, as in the case described here by way of example, there are therefore eight locations at which auxiliary magnets may be arranged. However, it is sufficient if for every target position only one of these two locations is occupied. The one of the two locations is occupied which is left vacant by a stator winding, because this makes the more compact design possible. (Specification, page 5, lines 15-23)

Vector B_2 of the magnetic field generated by stator winding 2 lies precisely on the line bisecting the angle between two target positions Z_3 and Z_2. Therefore, it is not possible to set two target positions Z_2 or Z_3, by one of the stator windings being temporarily charged with current and rotor 7 then being left to the influence of the auxiliary magnets, which pull it into the desired target position. For this reason, three stator windings 1, 2, 3 are provided with current via a network. The network has four inputs 20_1 through 20_4 and three outputs 21_1 through 21_3. Inputs 20_1 and 20_4 make it possible for a current to flow via a diode 22_1, or 22_3, to winding 1, or 3, respectively. If one of these inputs is supplied with current, rotor 7 as a consequence adopts a first position, which corresponds to the orientation of a magnetic field B_1, or B_3. If input 20_2 is supplied with current, one part of the current flows via a diode 22_3 to winding 2 and the rest of the current flows via a diode 22_2 and a resistor 23_1 to winding 1. The magnetic fields generated by windings 1, 2 overlap each other in a field B_{21}, whose vector is depicted in Figure 1b by a dotted line. As a consequence, if input 20_2 is supplied with current, rotor 7 adopts a first position corresponding to field B_{21}, from which, if the power supply is switched off, it may reliably be pulled into target position Z_2 by corresponding auxiliary magnet 12. (Specification, page 5, line 25 to page 6, line 8)

By analogy to input 20_2, input 20_3 is connected via diode 22_4 to winding 2 and via diode 22_5 and a resistor 23_3 to winding 3, so that a current that is applied to the network at input 20_3 is distributed over windings 2, 3 and results in a superimposed magnetic field B_{21}. In this manner, by one of inputs 20_1 through 20_4 of the network being selectively charged with current, it is possible to place rotor 7 in one of a plurality of first positions and subsequently, under the influence of auxiliary magnets 11 through 14, to cause it to pass to a target position, which may be offset with respect to the first position by a small angle. Optionally, a resistor 23_3 may be arranged upstream of output 21_2 that is assigned to winding 2, to make the resistance of the arrangement made up of network and windings the same for all inputs 20_1 through 20_4 of the network. (Specification, page 4, lines 14-26)

In addition, magnetic fields B_1, B_2 and B_3 do not necessarily have to be generated by one single stator winding. Thus, if one of the stator windings, for example winding 2, is supplied with a current in accordance with the signs indicated at their terminals 8, it is conceivable, in order to generate field B_2, to simultaneously supply current to stator windings 1 and 3 in series with each other and parallel to winding 2, in accordance with the signs indicated at terminals 8 of windings 1 and 3, so as, in this manner, to strengthen the magnetic field in the interior space of ring core 5, to which rotor 7 is exposed. (Specification, page 7, lines 26-23)

6. ISSUES

Under 35 U.S.C. § 103(a), are claims 13, 14, 16-23, and 25 unpatentable over United States Patent No. 4,983,867 to Sakamoto ("Sakamoto") in view of United States Patent No. 4,755,732 to Ando ("Ando")?

Under 35 U.S.C. § 103(a), is claim 24 unpatentable over Sakamoto in view of Ando and further in view of United States Patent No. 4,803,389 to Ogawa et al. ("Ogawa")?

7. GROUPING OF CLAIMS

Claims 13, 14, 16-23, and 25 stand or fall together.

Claim 24 stands or falls alone.

8. ARGUMENT

Claims 13, 14, 16-23, and 25 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Sakamoto in view of Ando.

Before discussing these references, Appellant shall first focus on the claim language at issue here. Claims 13 and 23 recite that a rotary actuator includes a permanently magnetized rotor and a plurality of stator windings surrounding the permanently magnetized rotor in a rim-like fashion and for generating a magnetic field. The stator windings place the permanently magnetized rotor in one of a first plurality of positions and the stator windings are coplanar and arranged so as to be unpaired. Furthermore, claims 13 and 23 recite that a rotary actuator includes "an arrangement for exerting a corrective torque on the permanently magnetized rotor".

Sakamoto states that a hybrid-type stepping motor includes "a rotor including disc-like magnetic poles each having many pole teeth in the outer periphery, and including a permanent magnet magnetized in the axial direction to form 2 poles and having opposite ends respectively abutting against the disc-like magnetic poles thereby to constitute the hybrid-type stepping motor, and the number of pole teeth, Z, of the rotor and a step angle are designed to satisfy particular conditions." (Col. 7, lines 48-58) Furthermore, Sakamoto states that "[t]he rotor is formed by 2 (two) rotary plates having a multiplicity of gear-like salient poles, and a permanent magnet sandwiched between the rotary plates and magnetized in the same direction as a rotary shaft." (Col. 2, lines 12-15) The motor of Sakamoto only includes a rotor with magnetic poles and a magnet. Sakamoto does not teach that a rotary actuator includes an arrangement for exerting a corrective torque on a permanently magnetized rotor, as recited in claims 13 and 23.

Ando describes a microangle drive circuit for a stepping motor that includes "output elements pairs of which are connected to one another in series, a sense resistance connected to the output elements in series to make a motor coil control circuit for a phase or coil, a stepping motor control circuit made for n-phases, and motor coils. These circuit and system increase accuracy in rotation and stop by dividing the rotation angles of the stepping motor into microangles." (Abstract, lines 1-9) Furthermore, Ando states that "[t]he microangle drive circuit of the first embodiment comprises output elements Tr1, Tr2,--- pairs of which are connected to one another in series, a sense resistance R1 connected to the side of ground of the output elements Tr2, Tr4 in series to make a motor coil control circuit M1 for a phase, a stepping motor control circuit S made by connecting a plurality of the motor coil control circuits M1-----for n-phases in parallel, and motor coils connected to one another end-to-end in a ring, each of the connection points thereof being connected to each of the connection points of the output elements correspondingly." (Col. 2, lines 27-38) Also, Ando states "[t]he microangle drive circuit of the second embodiment comprises a motor coil control circuit for a phase made by connecting pairs of output elements in series, rated current drive circuits made by connecting a plurality of the motor coil control circuits for n-phases in parallel, a sense resistance for detection of a rated current connected to the output sides of the rated current drive circuits in series, motor coils connected to one another in a ring, each of the connection points thereof being connected to each of the connection points of the output

elements correspond to output elements for a microangle drive connected to each of the connection points of the output elements, the output elements for a microangle drive being connected to one another in parallel, and a further sense resistance for detection of a microangle current connected to the output sides of the output elements for a microangle drive." (Col. 2, lines 39-55) Ando does not teach that a rotary actuator includes an arrangement for exerting a corrective torque on a permanently magnetized rotor, as recited in claims 13 and 23.

In view of the above, it is respectfully submitted that the combination of Sakamoto and Ando is insufficient to support the obviousness rejection of claims 13 and 23.

Claims 14, 16-22, and 25, which depend from allowable claim 13, are similarly allowable by virtue of their dependence on allowable claim 13.

For at least the reasons discussed above, withdrawal of the rejection of claims 13, 14, 16-23 and 25 is hereby respectfully requested.

Claim 24 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over Sakamoto in view of Ando and further in view of Ogawa. Claim 24 depends on claim 13. Ogawa does not overcome the deficiencies of Sakamoto and Ando. In fact, Ogawa states that "[a] stepping motor includes a first element including at least two permanent magnets each having a pair of N and S poles and a second element including a yoke arranged to be separated from the first element by a predetermined interval" and "[t]he second element has a two-phase coil arranged on the yoke in association with a width of each pole in a moving direction of the permanent magnet and detent torque generating means for generating a static detent torque by relative movement." (Abstract, lines 1-11) Ogawa does not teach that a rotary actuator includes an arrangement for exerting a corrective torque on a permanently magnetized rotor, as recited in claim 13. Since Ogawa does not overcome the deficiencies noted above with respect to the rejection of claim 13 in light of the combination of Sakamoto and Ando, Appellant requests withdrawal of the rejection of claim 24.

A copy of the claims on appeal is attached hereto in the Appendix.

9. CONCLUSION

Reversal of the Examiner's rejection of the above-discussed claims is therefore respectfully requested.

Respectfully submitted,

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Dated: 4/24/04

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APPENDIX

13. A rotary actuator, comprising:

a permanently magnetized rotor;

a plurality of stator windings surrounding the permanently magnetized rotor in a rim-like fashion and for generating a magnetic field, the stator windings placing the permanently magnetized rotor in one of a first plurality of positions, wherein the stator windings are coplanar and arranged so as to be unpaired;

an arrangement for exerting a corrective torque on the permanently magnetized rotor, the arrangement for exerting the corrective torque, in a currentless state of the stator windings, placing the permanently magnetized rotor in a target position of a second plurality of positions, each position of the first plurality of positions having assigned thereto a corresponding one of the second plurality of positions as the target position; and

a network having n inputs and m outputs, n being a number of the first plurality of positions and m being a number of the stator windings, wherein:

each one of the stator windings is connected to one of the m outputs, and

the network distributes to the stator windings a current applied at one of the n inputs in order to set one of the first plurality of positions that is assigned to a respective one of the n inputs.

14. The rotary actuator according to claim 13, wherein:

the permanently magnetized rotor includes a magnet that is aligned so as to be perpendicular to a rotational axis.

16. The rotary actuator according to claim 13, wherein:

the stator windings are uniformly distributed around a rotational axis in a circumferential direction.

17. The rotary actuator according to claim 13, further comprising:

a ring core surrounding the permanently magnetized rotor and on which the stator windings are arranged.

18. The rotary actuator according to claim 13, wherein:

the number m of the stator windings is smaller than the number n of the first plurality of positions.

19. The rotary actuator according to claim 13, wherein:

the arrangement for exerting the corrective torque includes a plurality of permanent magnets.

20. The rotary actuator according to claim 13, wherein:

a resistance of all n inputs is the same.

21. The rotary actuator according to claim 13, wherein:

the stator windings include three stator windings, and

the plurality of first positions includes four first positions.

22. The rotary actuator according to claim 13, wherein:

adjoining target positions have an angular distance of 45°.

23. A rotary switch, comprising:

a rotary actuator that includes:

a permanently magnetized rotor;

a plurality of stator windings surrounding the permanently magnetized rotor in a rim-like fashion and for generating a magnetic field, the stator windings placing the permanently magnetized rotor in one of a first plurality of positions, wherein the stator windings are coplanar and arranged so as to be unpaired;

an arrangement for exerting a corrective torque on the permanently magnetized rotor, the arrangement for exerting the corrective torque, in a currentless state of

the stator windings, placing the permanently magnetized rotor in a target position of a second plurality of positions, each position of the first plurality of positions having assigned thereto a corresponding one of the second plurality of positions as the target position; and

a network having n inputs and m outputs, n being a number of the first plurality of positions and m being a number of the stator windings, wherein:

each one of the stator windings is connected to one of the m outputs, and

the network distributes to the stator windings a current applied at one of the n inputs in order to set one of the first plurality of positions that is assigned to a respective one of the n inputs.

24. The rotary switch according to claim 13, wherein:

the rotary switch is an "R"-type waveguide switch.

25. The rotary actuator according to claim 13, wherein:

the arrangement includes a plurality of elements that are arranged in an asymmetric manner about a longitudinal axis of the rotary actuator.